Subject Index

Actinolite 410
–, zoning 313
age determination, alpine dykes 45f.
åkermanite 160
Al, orthopyroxenes 186f.
alabandite, carbonatite 149f.
albite 313
albite melt 58f.
alkali basalt 321f.
–, chemical composition of different regions 332
–, Jan Mayen platform 216f.
–, magma 2f.
alkalifeldspar, granulites 96
alkaline volcanism, Mexico 321f.
–, origin 331f.
allanite 352, 388
almandine 227
alnöitic breccia, O fugacities of ilmenites 85f.
alpine dykes, age determination 45f.
alteration, ophiolites 248
amphibole 46, 260, 348, 352, 378f.
–, fluid inclusions 3f.
–, sodic, P indicator 311f.
amphibolite 226f.
– /granulite transition, H_2O activity 158f.
anatectic migmatites 30
andalusite 119, 337f.
andesine 356
andesite 239, 322f., 348
–, Vourinos ophiolite suite 255
andesitic inclusions, rhyolites 373
annealing, diffusion experiments 175
anorthosite 159, 279f.
apatite 281, 352, 388
–, carbonatite 149f.
–, granulites, U-Th-contents 97
aphyric inclusions, Coso lavas 356
–, rare earth element distribution 359
–, rhyolites 373
Appalachian anorthosites, age and origin 287f.
Arabian-Nubian shield, ophiolites 244f.
Archean gneisses, China, geochemistry 224ff.
Archean rocks, Finland, petrogenesis 292f.
Archean stratigraphy, Hebei 225
augen-gneiss 68, 282, 293f.
augite 46, 329
–, fluid inclusions 1f.

Ba, metamorphism 123
banded iron formations, Hebei 226f.
barroisite, amphibole zoning 313f.
basalt, contamination 366f.
–, hydrotherm. altered, REE pattern 409f.
–, Jan Mayen platform, geochemistry 211f.
–, magmatic inclusions 349f.
–, Vourinos ophiolite suite 255
basalt petrogenesis 357f., 404f.
benmoreite 321f.
–, derivation 332
Bi, metamorphism 125
biotite 32, 46, 68, 96, 119, 226, 293, 340, 348f.
blueschist facies rocks, pumpellyite 15
bustamite, enthalpy of formation 275
bustamite/johannsenite equilibrium 272f.

Calc-alkaline volcanism, Mexico 321
calcite 135, 149f., 159, 313
–, Adirondack marble, O and C isotopic fractionation 161f.
–, melting temp. lowering by H_2O 149
calcite-kimberlite 134
carbonatites, relation to kimberlites 133f.
cation diffusion, Ti-magnetites 174f.
Cd, metamorphism 127
channelized fluid, deep crust 158f.
charnockites 96, 279f.
chemical analysis, actinolite, Bathurst 317
–, albite, Bathurst 317
–, amphiboles, Vourinos 260
–, amphibole zoning, Bathurst 314
–, andesites, Vourinos 256
–, apatite, St. Paul 388
–, basalts, Jan Mayen platform 212
–, –, phenocrysts 217
–, –, Vourinos ophiolite suite 256
–, biotite, migmatites 34
–, –, Wadi Kid 340
–, calcite, Bathurst 317
–, carbonatite dike, Oka 150
–, –, carbonate minerals 152
–, –, olivine 153
–, –, oxide minerals 150
–, –, sulfide minerals 150
–, chlorite, Bathurst 317
–, clinopyroxene, peridotites 87
–, –, St. Paul ultramafics 388
–, –, Vourinos ophiolite series 258f.
–, clinopyroxene rims, melting experiments 104
–, clinopyroxenite, Krapa 266
–, dacites, Vourinos 256
–, dykes, alpine 47
–, –, Vourinos 257
–, epidotes, Bathurst 317
–, eulysites, Hebei 233
–, Fe-Ti oxides, Coso lavas 355
–, –, Mexican alkaline suite 322
–, gabbros, Vourinos 266
–, garnets, Wadi Kid Complex 339
–, glasses, melting experiments 106
–, gneiss, Archean 294
–, granulitic gneisses, Hebei 230
–, hornblende, migmatites 34
–, ilmenites, alnöitic breccia 86
–, –, kimberlites 86, 136
–, –, –, carbonate dykes 136
–, lavas, Coso 350f.
–, –, Sanganguey 325
–, leucosomes, Colorado migmatites 32
–, magnetite, Bathurst 317
–, –, Jan Mayen platform basalts 217
–, –, kimberlites 138
–, –, –, carbonate dikes 138
–, metapelites, Damara 120
–, migmatite minerals 34
–, muscovite, Bathurst 317
–, –, Wadi Kid Complex 340
–, Na-amphiboles, Bathurst 314
–, olivine, peridotites 87
–, –, platform basalts, Jan Mayen 217
–, –, Vourinos intrusives 260
–, olivine phenocrysts, alkaline lavas 328
–, orthopyroxene, peridotites
–, –, St. Pauls ultramafics 388
–, –, Vourinos intrusives 260
–, paleosomes, Colorado migmatites 32
–, phengite, Bathurst 317
–, phlogopite, St. Paul ultramafics 388
–, plagioclase, Mexican alkaline suite 330
–, –, Vourinos intrusives 260
–, –, Wadi Kid Complex 340
–, pumpellyites, Italian metamorphic rocks 16f.
–, pyroxenes, Coso lavas 353
–, –, lherzolites 394
–, –, Mexican alkaline lavas 329
–, rhyolites, Vourinos 256
–, selvage, Colorado migmatites 32
–, sphene, Bathurst 317
–, spinels, Mexican alkaline suite 331
–, St. Paul ultramafics, minerals 388
–, ultramafic rocks, Hebei 233
–, websterite, Asprokambo 267
–, wehrlites, Krapa 266
chlorite 3, 68, 96, 119, 245, 131
chromite 388
chromitite 254
cinder cones, Sangangvey 321f.
clinochlore 318
clinopyroxene 46, 87, 96, 226, 324, 362, 388
–, basalts, phenocrysts 216f.
–, cumulates 259
–, fractionation density 303
–, wehrlite, fluid inclusions 2f.
clinopyroxenite 254
clinozoisite 318
CO, peridotite xenolith fluid inclusions 1f.
CO_2, peridotite xenolith fluid inclusions 1f.
CO–CO_2, phase equilibria 5f.
colour, monazites 141f.
contaminants, mafic lavas 358
contaminated basalts, magmatic inclusions 349f.
contamination, basalts 366f.
cordierite 119, 337f.
corundum 74
crossite, amphibole zoning 313f.
crustal interaction, Coso lavas 366f.
crust reworking, Archean magmatism 297
crystal fractionation, alkaline suite 332f.
crystal-liquid equilibria, silicate melts 103f.
Cu, metamorphism 128
cumulates, Vourinos ophiolites 253f.

Dacite, Vourinos ophiolites 255
dashkesantite 388
density, basaltic magmas 300f.
density determination, melts 301
depletion, radioactive elements in granulites 95
diapirs, carbonatites 134
differentiated basalts, magmatic inclusions 349
differentiation, carbonatite petrogenesis 134
–, metamorphic 30
diffusion, Ti-magnetites 174f.
diktytaxitic texture, magmatic inclusions 347
diopside 216, 226, 410
–, Gibbs free energy of melting 60

–, harzburgites 393f.
–, solidus 58f.
diorite 239, 354
distribution coefficients, coex. metamorphic minerals 118
dolomite, Adirondack marble, O and C isotopic composition 161f.
–, carbonatite 149f.
domain boundaries, monazite 146
DTA, diopside melting 60
dunite 254
dykes, alpine, geochronology 45f.

Edenite 317
element behaviour, metamorphism 122f.
element depletion patterns, metamorphism 130
element mobilisation, metamorphism 116f.
enstatite 260, 406
enthalpy diagram, point defect formation in magnetites 179
ephesite, thermal stability 74f.
–, thermodynamics 80f.
epidote 68, 313
equilibrium, Al in coex. orthopyroxene-spinel-forsterite 186f.
equilibrium conditions, ophiolitic lherzolites 400
Eu anomalies, granulites 235f.
–, magmatic inclusions in rhyolites 359
eucryptite 74
eulite 227
eulysites 233f.
eutectic vapor phase, Oka carbonatite 151
exchange reactions, pyroxenes 107f.

Feldspar, composition in alkaline lavas 330
ferrodiorite 281
fluid, granulite facies metamorphism 158ff.
fluid composition, migmatization 41f.
fluid dynamics, magma chamber 305
fluid inclusions, peridotite xenoliths 1f.
fluid-rock reaction, granites 70
fO_2 megacryst ilmenites from peridotites 88f.
forsterite, Al content equilibrium 186f.
forsterite-quartz-anorthite, liquidus phase relations 405f.
fractional crystallization, alkaline suite 333
–, basaltic liquids 240f.
–, –, density changes 300f.
–, Jan Mayen platform basalts 220
fractionation, low-pressure ophiolites 253f.
–, O and C isotopes during granulite facies metamorphism 160f.
fractionation density 302
Frenkel type defects, magnetites 179
fugacities, gas in carbonatite melts 149f.

Gabbro 239, 245f., 254, 322
–, Soret effect 203f.
gabbronorite, fractionation density 303
garnet 47, 119, 226, 337
gas species, carbonatite dike, fugacities 149f.
geobarometry, Wadi Kid gneisses 339f.
geochronology, alpine dykes 45f.
–, Archean Finnish terrains 295f.
–, Blue Ridge suite 282f.
–, Chinese granulite gneisses suite 224ff.
–, Saudi Arabian ophiolites 224ff.
geothermometry, Al in coex. orthopyroxene spinel-forsterite 192f.
–, Fe-Ti oxides in Coso lavas 356f.
–, Wadi Kid gneisses 339f.
glass, magmatic inclusions 347
glaucophane 313f.
gneiss 68, 281, 292f.
–, Archean, Hebei 224ff.
–, migmatization 30f.
–, Napier Complex, U-Pb data on monazites 143
–, Wadi Kid Complex 337f.
granite, Archean terrains, Finland 293f.
–, O isotope systematics 67f.
granite-gneiss terrains, Kainuu 292f.
granitic magmas, origin 25f., 72
granulites 279f.
–, Qianxi 226ff.
–, rare earth geochemistry 233f.
granulite facies metamorphism, Blue Ridge 280f.
granulite terrain, distribution of radioactive elements 95f.
graphite, precipitation from a CO_2-CO fluid, calculation 8
greenschist/blueschist facies transition, amphibole zoning 317
greenstone belt, Kainuu 292f.
Grenville orogeny 159, 279
Grenvillian Belt, Sweden 67f.
–, O isotope systematics 67f.

Harzburgite 255
–, ophiolites, equilibrium state 391f.
hastingsite 46
hawaiites 321f.
–, derivation 332
heat flow, granulite terrain 98
heat production, radiogenic 98
heat transfer, metamorphism 158f.
hedenbergite, Fe substitution by Mg 275
Hg, metamorphism 126
high-grade metamorphic rocks, Rb/Sr and sm/Nd geochronology 286
H_2O, carbonatite petrogenesis 149f.
–, diopside melts, thermodynamics 58f.
hornblende 32, 46, 96, 226, 293, 316, 378f.
hornblende gabbro 245
hornblendite 378f.

Idaho Springs Formation, Colorado 30f.
ijolite-carbonatite complex, Oka 149f.
ilmenite 106, 134, 284, 352f.
–, carbonatite/kimberlite link 133f.
–, kimberlitic, O fugacities 85f.
inclusions, magmatic in volcanic rocks 346ff.
infiltration, migmatization 30f.
infiltration experiments, partial melting 27
interdiffusion coefficients, calculation 177
interdiffusion experiments, Ti-magnetites 174f.
interface, quartzite/melt 27
intracrustal melting 240
island arc origin, Vourinos ophiolites 253f.
island arc volcanism 249f.
isograds, Damara metapelites, relation to element mobilisation 119f.
isotopic equilibrium, granulite facies metamorphism 160f.
Johannsenite/bustamite equilibrium 272f.
jotunite 282

K, granulite terrains 97
K – Ar dating, alpine dykes 49f.
kaersutite 46, 388
–, fluid inclusions 3f.
K – feldspar 68, 160, 226, 284, 337
kimberlite – carbonatite relationships 133f.
kimberlitic ilmenites, O fugacities 85f.
komatiites 235
kyanite 119

Lavas, magmatic inclusions 349f.
–, Sanganguey 321f.
lawsonite, pumpellyite association 15
layered gabbro 245
leptinites 226f.
leucite 106
leucogranites 293
leucosome 30f.
–, formation 35
lherzolites, ophiolites 391f.
liquidus phase relations, basalt petrogenesis 404f.
listwänite 246
lit-par-lit injection, migmatization 30

Magma chamber, basaltic, dynamical behavior 300f.
– fluid dynamics 305f.
–, low-pressure, magmatic fractionation 262f.
–, ophiolite formation 253f.
magma fractionation, Soret effect 197f., 203f.
magnesiochromite, basalt phenocrysts 216
magnesioferrite, carbonatite 149f.
magnetite 33, 87, 134, 313, 352
–, basalt phenocrysts 216
–, carbonatite/kimberlite link 133
–, Fe-self-diffusion 178f.
mantle evolution, Arabian shield 249
mantle heterogeneity 218
mantle peridotite, partial melting 134
mantle source, gneiss 293
marble 159
marble/granite contact, stable isotopes 171f.
margarite 74
mass-balance, migmatization 30f.
mass-transfer, migmatites 30f.
melange 246
melanosome 31
melilite 106
melting, mantle peridotite 240f.
melting experiments, pyroxenes 103f.
melts, densities 301
–, thermodynamic properties 105f.
mesoperthite, charnockites 96
meta-amphibolite, pumpellyite occurrence 22
metabasites, Appalachians, Na-amphiboles 311f.
metamorphic differentiation, migmatization 30f.
metamorphic facies, pumpellyite occurrence 19f.
metamorphic fluids 158ff.
metamorphic zonation, Wadi Kid 338f.
metamorphism, Alps and Apennines 14f.
–, formation of hydrothermal deposits 116f.

–, granulite facies, fluid heterogeneity 158ff.
–, high-grade, Wadi Kid area 336f.
metapelite, loss of metals during metamorphism 116f.
metasomatism 30f.
–, petrogenesis of ultramafics 385
mica schists, Archean Hebei rocks 226f.
microcline 32, 281, 293
microthermometry, fluid inclusions 1f.
mid-ocean ridge basalt, Soret separation 197f., 203f.
migmatization 292
–, mechanisms 30
migmatite, H_2O acitivity 159f.
–, mass-transfer 30f.
migration, metamorphic fluids 158f.
mixing models, rhyolite petrogenesis 371
Miyashiro diagram, Bathurst amphiboles 316
monazite, microstructure 143f.
–, Pb isotopic composition and colour 141f.
monzonite 282
mugearite 321f.
–, derivation 332
muscovite 119, 340
mylogneiss 68
mylonitization, St. Paul 378

Natrolite 388
Nb_2O_5/MnO, ilmenites from carbonatites 135
Nd isotopic data, St. Paul hornblendites 378f.
Nd – Sr correlation, oceanic island basalts 381
nelsonite 279
nepheline 74, 106
norite 254
–, fractionation density 303

Ocelli, carbonatites 133
O fugacities, kimberlitic ilmenites 85f.
–, upper mantle 1f.
oligoclase 356
olivine 87, 106, 134, 194, 324, 329, 352, 378f.
–, carbonatite 149f.
–, fractionation density 303
–, Jan Mayen platform basalts 216
–, wehrlite, fluid inclusions 2f.
olivine gabbro, fractionation density 303
olivine-plagioclase pairs, Soret effect studies 197f., 203f.
ophiolites, cumulate formation 253f.
–, harzburgite equilibrium state 391f.
–, pumpellyites 14f.
–, Saudi Arabia, Sm-Nd data 244ff.
–, tectonic settling 248
ophiolitic harzburgites 391f.
orthopyroxene 87, 96, 352
–, Al content equilibrium 186f.
–, cumulates 259
–, fractionation density 303
–, granulites 226f.
oxidation state, silicate melt 1f.

Paleosome 30f.
Pan-African event 336, 343
paragonite 119
pargasite 46, 378f.
partial melting 158f., 239
–, basalt petrogenesis 360
–, carbonatite petrogenesis 134
–, gneiss petrogenesis 293
–, migmatization 30
Pb, metamorphism 124
Pb, isotopic composition, Antarctic monazites 141f.
–, Coso lavas 367
–, St. Paul hornblendites 381
pegmatite 281
periclase, carbonatite 149f.
peridotite 245, 254
–, fO_2 in ilmentes 86
–, geothermometry 194
–, source of alkali basalts 387
peridotite xenoliths, fluid inclusions 1f.
perovskite 134
perthite 33, 281
pervasive fluid, deep crust 158f.
phase diagrams, Soret effect on liquidus 200
phengite 313
phenocryst, composition in Coso lavas 353
–, Sanganguey lavas 324
phenocryst geochemistry, platform basalts, Jan Mayen 217f.
phlogopite 159, 338
pigeonite 106
pillow basalt, Jan Mayen platform 210f.
plagioclase 32, 46, 68, 96, 106, 119, 226f. 245, 260, 293, 324, 340, 352, 410
–, basalt phenocryst composition 216f.
–, fractionation density 303
–, pumpellyite association 18
point defects, magnetite, enthalpy diagram 179f.
polytypes, ephesite 75
porphyritic inclusions, rhyolites 347f., 373
–, rare earth elements 359
prehnite 33
pumpellyite, low-grade metamorphic rocks 14f.
pumpellyite composition, relation to metamorphic conditions 18f.
pyroxenes, zoning 103f.
pyroxenite 254
pyrrhotite, carbonatite 149f.

Qianxi group, Archean, China 224f.
quartz 32, 68, 119, 159, 226, 254, 260, 313, 352, 405
–, granulites 96
quartz-albite melt, infiltration 25f.
quartzite, melt infiltration 26f.
quartz monzonite 282

Radioactive elements, distribution in granulite terrains 95f.
radiogenic heat production 98
Raman spectra, fluid inclusions of peridotite xenoliths 4
rare earth elements, carbonatite 150
–, enrichment in hornblendites 383
–, Jan Mayen platform basalts 214
rare earth geochemistry, eulysites 235
–, granulitic gneisses 234f.
–, patterns, hydrotherm. altered basalts 409f.
Rb, granulite terrains 97
–, metamorphism 123
Rb/Sr, granulites 237
Rb-Sr data, Archean Finnish gneisses 294
–, Blue Ridge suite 282
Rb-Sr dating, alpine dykes 52
rhodonite 275
rhyolite 322
–, Coso, source regions 370
–, magmatic inclusions 349f.
–, Pb and Sr isotopic composition 360ff.
–, Vourinos ophiolite suite 255
rifting, Mexico 321
rodingite, pumpellyite occurrence 23

Salite 46, 216
sanidine 352
saussuritization 245
scapolite 388
seamounts, Jan Mayen 210
seawater/basalt alteration 410f.
selvage, migmatization 30f.
serpentine 135, 389
shoshonitic dykes, Alps 46
silicate melt, oxidation state 1f.
sillimanite 31, 119, 159, 337f.
skarn, stable isotopes 170f.
skarn minerals 277
smectite, altered basalts 410
Sm-Nd, ophiolites 244ff.
Sm-Nd data, Blue Ridge suite 284f.
Soret effect, pseudo-liquidus 200
Soret separation, mid-ocean ridge basalts 197f., 203f.
sodalite 388
sodic amphiboles, Appalachians 311f.
solid solution, ephesite-margarite 74
–, Ti-magnesites 174f.
solidus, Al-silicates 58
solubility, H_2O in silicate melts, thermodynamics 58f.
sphene 33, 313
spinel 87, 106, 353
–, Al content equilibrium 186f.
–, basalt phenocrysts 216
–, carbonatite/kimberlite link 133f.
–, cumulates 259
spinel lherzolites, geothermometry 194
spinel peridotite 378
spreading center, Soret effect on gabbros 203f.
Sr, metamorphism 126
Sr isotopic composition, Coso lavas 369
–, hornblendites, St. Paul 380f.
–, metamorphism, granulite facies 158f.
staurolite 119, 337f.
stilpnomelane 313
subduction, Mexico 321
subduction zone, Bathurst Appalachians 311f.
substitutions, clinopyroxenes 103f.
surface energy, partial melting 25f.
systems, $MgO-Al_2O_3-SiO_2$, Al content equilibrium 186f.
–, $NaAlSiO_4-LiAlSiO_4-Al_2O_3-SiO_2-H_2O$, thermodynamics 82f.

Tectonism, Alps 45
textures, granulites 96
Th, distribution in granulite terrains 97f.
thermobarometry, ophiolitic harzburgites 397
thermodynamics, Al equilibrium in coex. orthopyroxene-spinel-forsterite 190f.
–, johannsenite/bustamite inversion 276
tholeiites, REE pattern 409f.
Ti, distribution between pyroxenes and melt 110

titanomagnetite 331
–, diffusion 174f.
Tl, metamorphism 123
tonalite 239, 322
trace elements, granulitic Hebei gneisses 230
–, lavas 351
–, Mexican alkaline lavas 326
tracer, Ti diffusion in magnetites 180f.
tremolite 159, 388
troctolite, fractionation density 303
trondhjemite 239
tschermakite 388
turbidites, Jan Mayen platform 211

U, distribution in granulite terrains 97f.
ultramafics, St. Paul, REE characteristics 384f.
ulvospinel, diffusion 178
undercooling, magmatic inclusions 346f.
upper mantle, fO_2 zones 93
–, generation, Vourinos 253f.
–, magma equilibration 376f.
–, oxidation state 85f.
–, processes 134
uralite 245

Vapor phase composition, Oka carbonatite 151
volatilization, metamorphic, ^{18}O depletion 167f.
volcanism, Jan Mayen platform 210f.

Water activity, deep crust 158f.
websterite 254
wehrlite 87, 254
–, phases, fluid inclusions 1f.
wollastonite 159, 275

Xenoliths, fluid inclusions 1f.
–, granulites, stable isotopes 168f.

Zircon 352, 389
–, granulites, U-Th-contents 97
Zn, metamorphism 127
zonation, magmatic systems 373
zoning, amphiboles 312f.
–, –, development 315f.
–, plagioclase phenocrysts 217f.
–, pyroxenes 103f.

List of Locations

Adirondacks 159
Al Amar-Idsas, Saudi Arabia 245
Aliakmon, Greece 254
Altenberg, Tauern Alps 55
Ånimmen-Vänern area, Sweden 68
Ånimskog, Sweden 68
Arabian-Nubian Shield 245
Armstrong Brook, Bathurst 312
Arola, E-Central Finland 293
Asprokambo, Greece 254

Badaohe, Hebei 225
Bathurst, New Brunswick, Canada 312
Benfontein Sills, S. Africa 134
Bir Umq, Saudi Arabia 245
Blue Ridge, Virginia 279
Bolet, Sweden 68

Calabria, Italy 15
Ceboruco Volcanoe, Mexico 322
Chapala Graben, Mexico 322
Clear Creek Traverse, Colorado 31
Colima Graben, Mexico 322
Colima Volcanoe, Mexico 322
Coso, California 346, 366

Dalebergen, Sweden 68
Damara Orogen, Namibia 117
Drau Chain, Alps 46

Excelsior pipe, S. Africa 86

Frank Smith pipe, S. Africa 86
Front Range, Colorado 31

Gailtal, Alps 46
Goldeck, Alps 46

Hebei Province, China 225
Hulayfah, Saudi Arabia 245
Husereau Hill, Oka 149

Jabal al Wask, Saudi Arabia 245
Jabal Ess, Saudi Arabia 245
Jan Mayen Platform, Atlantic 210
Jequié, Brasil 95

Kainuu, Finland 292
Kivijärvi, Finland 293
Knipovich Ridge, Jan Mayen 210
Krapa, Greece 254
Kreuzeck, Alps 46
Kuhmo, Finland 293

Lake Chapala, Mexico 322
Langhadhakia, Greece 254
Ligurian Apennine, Italy 15
Lovingsston Massif, Virginia 280
Lucanian Apennine, Italy 15
Luoma, Finland 293

Malaita, Solomon Islds. 86
Mandania, Greece 254
Maritime Alps, Italy 15
Mikroklisoura, Greece 254
Mohns Ridge, Jan Mayen 210
Mukorob pipe, S. Africa 86

Naavala, Finland 293
Napier Complex, Antarctica 141
Navajos Volcanoe, Mexico 322

Oka Complex, Quebec 149

Pedlar Massif, Virginia 279
Premier Mine, S. Africa 134

Qianxi, Hebei 225

Rensenspitze, Tauern Alps 55
Rieserferner, Tauern Alps 55

San Carlos, Arizona 86
Sandviken, Sweden 68
Sanganguey Volcanoe, Mexico 322
San Juan Volcanoe, Mexico 322
Sanmendian, Hebei 225
Santanying, Hebei 225
Sekamang pipe, S. Africa 86
Sinai 337
Sta. Maria del Oro Caldera, Mexico 322
St. Paul, Atlantic 377
Suomussalmi, Finland 293

Taipingzhai, Hebei 225
Tauern Window, Alps 46
Tepetiltic, Mexico 322
Tepic, Mexico 322

Vourinos, Greece 253

Wadi Kid Complex, Sinai 337
Wesselton Mine, S. Africa 134
Wöllatratten, Tauern Alps 55

Zinsnock, Tauern Alps 55